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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the separator for sealing form lead accumulators, especially, can maintain the high pressure force within a sealing form lead accumulator, and relates to the separator for sealing form lead accumulators which can attain reinforcement of a cell.

[0002]

[Description of the Prior Art] It is known that the paper-milling sheet of the super-thin glass fiber of 2 micrometers or less of diameters of average fiber shows the good engine performance as a separator for sealing form lead accumulators conventionally. However, since the paper-milling sheet of such a super-thin glass fiber has low reinforcement, it is hard to deal with it and it has the fault that the workability at the time of cell assembly is bad.

[0003] Then, without causing the degradation of the paper-milling sheet of a super-thin glass fiber, the amelioration which reinforces a paper-milling sheet is made and the following is proposed.

[0004] ** Immerse and dry this in a silica sol water solution after the separator fiberglass mat formation for sealing form lead accumulators which carried out silica sol processing (DE 3624378A1, JP, 2-181362, A). In addition, alumina sol is also confirmed in addition to the silica sol, the tensile strength of a separator is improved by using a silica sol and alumina sol as a binder, and a battery life is improved.

[0005] ** Many especially (JP, 4-32158, A) invention that improves a battery life and that mixes silica powder or acid-proof inorganic powder is conventionally made by mixing silica powder and a glass fiber as 50-300 micrometer acid resistance inorganic powder of separators for sealing form lead accumulators of silica mixing.

[0006]

[Problem(s) to be Solved by the Invention] By the way, it is important to apply the pressure force to the plate which sandwiches a separator within a cell as a cure against reinforcement of a sealing form lead accumulator, and to maintain this pressure force. However, even if it had the fault that the pressure force declined sharply when the separator for sealing form lead accumulators which made the super-thin glass fiber the subject contained the electrolytic solution, and it was a separator using an above-mentioned silica sol or silica powder, it was difficult to fully raise the pressure force within a cell.

[0007] This invention solves the above-mentioned conventional trouble, and it aims at offering the separator for sealing form lead accumulators which can maintain the high pressure force within a cell.

[0008]

[Means for Solving the Problem] The separator for sealing form lead accumulators of claim 1 is a separator constituted considering a glass fiber as a subject, and is characterized by coming to mix a glass fiber, silica powder, and a silica sol.

[0009] In the separator for sealing form lead accumulators of claim 1, the rate of silica powder to the sum total weight of a glass fiber, silica powder, and silica sol solid content is 1 - 40 % of the weight, and the separator for sealing form lead accumulators of claim 2 is characterized by the rate of silica sol solid content being 0.5 - 20 % of the weight.

[0010] The separator for sealing form lead accumulators of claim 3 is characterized by for the mean particle diameter of silica powder being 30micro or less, and specific surface area being more than 100m² / g in claim 1 or the separator for sealing form lead accumulators of 2.

[0011] The separator for sealing form lead accumulators of claim 4 is characterized by the mean particle diameter of the silica particle in a silica sol being 40nm or less in the separator for sealing form lead accumulators of claim 1 thru/or any 1 term of 3.

[0012] Hereafter, this invention is explained to a detail.

[0013] Since it has a possibility that the maximum pore size of a separator may become large, the liquid holding power by capillarity may decline, and the stratification-ized prevention effectiveness of the electrolytic solution may not fully be acquired when the fiber diameter of the glass fiber used by this invention is too large, it sets preferably 2 micrometers or less of average fiber diameters to 0.9 micrometers or less. Moreover, if the diameter of a glass fiber is too small conversely, since a separator will serve as cost quantity, it is suitable to be referred to [0.4 micrometers or more] especially as 0.6 micrometers or more. That is, in this invention, it is desirable [especially the average fiber diameter of the glass fiber to be used] to especially be referred to as 0.6-0.9 micrometers 0.4-0.9 micrometers 2 micrometers or less.

[0014] In this invention, only the above-mentioned super-thin glass fiber may be used as a glass fiber, and the average fiber diameter of 2 micrometers is exceeded, it may mix on the above-mentioned super-thin glass fiber two to 50% of the weight, and the diameter glass fiber of the inside of 30 micrometers or less may be used for it.

[0015] Glass fiber cost can be reduced by use of such a diameter glass fiber of inside.

[0016] It is desirable that they are more than the mean particle diameter of 30micro or less, and specific surface area of 100m² / g as silica powder used in this invention. Whether the mean particle diameter of silica powder exceeds 30micro or specific surface area exceeds 100m² / g, sufficient improvement effect by this invention is not acquired.

[0017] Moreover, as for the silica particle in a silica sol, it is desirable that it is the mean particle diameter of 40nm or less. Sufficient improvement effect according that it is that to which the mean particle diameter of this silica particle exceeds 40nm to this invention is not acquired.

[0018] In addition, as for a silica sol, what contains such a silica particle at 1 - 50% of the weight of a rate is desirable. such a silica sol -- paper milling -- it puts into service water and adds.

[0019] In this invention, it is desirable to use silica sol solid content for silica powder at 0.5 - 20% of the weight of a rate one to 40% of the weight to the sum total weight of a glass fiber, silica powder, and silica sol solid content. A separator becomes hard and is not desirable if many [if there are few rates of silica powder and a silica sol than the above-mentioned range, sufficient improvement effect by this invention will not be acquired, and / conversely].

[0020] Organic fiber, such as a polyethylene fiber, natural needle-leaf tree system pulp, a synthetic fibrillation cellulose, etc. can be used for the separator for sealing form lead accumulators of this invention if needed besides a glass fiber, silica powder, and a silica sol, and let that amount used be 20 or less % of the weight of organic fiber, 5 or less % of the weight of natural needle-leaf tree system pulp, and 5 or less % of the weight of synthetic fibrillation celluloses to glass fiber weight in this case.

[0021] The separator for sealing form lead accumulators of this invention can be manufactured by mixing according to a conventional method except mixing silica powder and a silica sol with a glass fiber. In addition, in order to make formation of the silica gel after desiccation good, it is desirable to perform desiccation of a paper-milling mat about 5 to 60 minutes at 110-250 degrees C.

[0022]

[Function] It is mentioned that gel exists in a separator system as conditions for maintaining the pressure force in a sealing form lead accumulator. That is, although the detail of this reason is unknown, if gel exists, swelling is done so in a system and the pressure force can be maintained.

[0023] this invention persons presumed only silica powder to be that from which it is the cause that the gel state which demonstrates swelling is not fully formed by the system which used only the silica sol, as a result of the conventional separator which used silica powder or a silica sol examining the reason

which cannot fully raise the pressure force within a sealing form lead accumulator.

[0024] On the other hand, the separator for sealing form lead accumulators which can fully maintain the pressure force is offered, without reducing the pressure force which after electrolytic-solution impregnation requires for a plate by carrying out concomitant use addition and mixing silica powder and a silica sol in a glass fiber according to this invention. Only in the bottom of coexistence with silica powder and a silica sol, in the desiccation process after mixing, the good gel state is formed in a separator and this is considered because the pressure force is maintained by the swelling.

[0025]

[Example] An example, the example of a comparison, and the example of reference are given to below, and this invention is more concretely explained to it.

[0026] The separator for sealing form lead accumulators was manufactured by the paper-milling raw material combination shown in examples 1-4, example 1-5 of comparison, and example of reference 1 table 1, many of the properties were measured, and the result was shown in Table 1. However, in the example 4 of a comparison, it was immersed in the silica sol and the paper-milling mat of a glass fiber was manufactured. In addition, the detail of the used raw material is as follows.

[0027]

super-thin glass fiber : Diameter glass fiber of the inside of the average fiber diameter of 0.8 micrometers : Average fiber-diameter polyethylene fiber of 4.0 micrometers: Average fiber diameter silica powder [of 20 micrometers] I : The mean particle diameter of 2micro, specific surface area of 200m² / g silica powder II : The mean particle diameter of 10micro, and the specific surface area of 150m² / g silica powder III : The mean particle diameter of 80micro, specific surface area of 200m² / g silica sol : 20 % of the weight of contents of a silica particle, mean-particle-diameter alumina sol of 15nm of a silica particle : The measuring method of each property is as follows again the content of 20 % of the weight of an alumina particle, and the mean particle diameter of 15nm of an alumina particle.

[0028] It is the value acquired by *(ing) eyes sample weight in sample area.

It is a thickness sample to the thickness direction 20 kg/dm² It measures in the condition of having pressed by the load (JISC-2202).

[0029] An absorbent sample is made perpendicular, the lower part is immersed in the dilute-sulfuric-acid liquid of specific gravity 1.30, and it asks by measuring the time amount which goes up to height of 100mm.

[0030] 20 kg/dm² cut to pressure force retention 10cmx10cm Under a load, ten samples of 1mm thickness are set in a plastic bag 2, as shown in drawing 1 , a handle 3 is turned, and they are 20 kg/dm². A load is applied in the thickness direction of a sample 1. In addition, a load is detected by the load cell 4 and read with a pressure gage 5. The sulfuric-acid liquid 6 of specific gravity 1.3 is infiltrated into the sample 1 in the 130ml plastic bag 2 in this condition, the load of 1 hour after is measured, and it asks for the rate to an early load.

[0031]

[Table 1]

例		実 施 例				比 較 例					参考例
		1	2	3	4	1	2	3	4	5	1
材 料 (重 量 部)	極細ガラス繊維	75	55	75	52	100	90	80	90	90	75
	中径ガラス繊維		20		20						
	ポリエチレン繊維				8						
	シリカ粉末I	20	20		15			20			
	シリカ粉末II			20							
	シリカ粉末III										20
	シリカゾル (固形分)	5	5	5	5		10		10		5
	アルミナゾル (固形分)									10	
目付 (g/m ²)		188	195	178	167	160	165	189	164	162	188
厚さ (mm)		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
吸液性 (mm/5分)		182	167	175	143	125	139	156	128	121	182
最大孔径 (μm)		23	28	25	29	22	23	27	22	29	35
圧迫力保持率 (%)		95	101	92	93	68	75	71	73	49	77

[0032] The following thing is clearer than Table 1.

[0033] That is, the separator of the examples 1-4 which used silica powder and a silica sol together by this invention has high pressure force retention, and it turns out that reinforcement of a cell can be attained. On the other hand, pressure force retention is low, and the separator (example 1 of a comparison) of only a glass fiber is not enough although pressure force retention is raised a little with a silica sol and the separator (examples 2 and 3 of a comparison) only using either of the silica powder. Effectiveness sufficient by what infiltrated the silica sol into the mat (example 4 of a comparison) is not acquired. In the thing (example 5 of a comparison) using alumina sol, pressure force retention falls rather than the case of only a glass fiber.

[0034] In addition, in the example 1 of reference, although silica powder and a silica sol are used together, since the particle size of silica powder is large, although the improvement effect of pressure force retention is large compared with the case of silica sol or silica powder independent use, it is not enough, and an average aperture also becomes large.

[0035]

[Effect of the Invention] According to the separator for sealing form lead accumulators of this invention, it is supposed that it is possible for after electrolytic-solution sinking in to be able to maintain the pressure force highly between the plates in a sealing form lead accumulator, therefore to attain large reinforcement of a sealing form lead accumulator as explained in full detail above.

[0036] According to the separator for sealing form lead accumulators of claims 2-4, the further excellent pressure force retention can be obtained certainly.

[Translation done.]